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Stephan Manning
University of Massachusetts Boston, stephan.manning@umb.edu

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Stephan Manning

University of Massachusetts Boston
100 Morrissey Boulevard
Boston MA 02125
Email: Stephan.manning@umb.edu

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ABSTRACT

This paper explores knowledge services clusters (KSCs) as a distinct and increasingly important form of geographic cluster, in particular in emerging economies: KSCs are defined as geographic concentrations of lower-cost skills serving global demand for increasingly commoditized knowledge services. Based on prior research on clusters and services offshoring, and data from the Offshoring Research Network (ORN), major properties and contingencies of KSC growth are discussed and compared with both high-tech clusters and low-cost manufacturing clusters. Special emphasis is put on the ambivalent effect of commoditization of knowledge work on KSC growth: It is proposed that KSCs attract most projects if service commoditization is medium, whereas higher or lower commoditization either increases global competitive pressure or lowers demand and economies of scale and scope. KSC attractiveness is further related to the perceived availability of skills at relatively low costs, and cluster connectedness with client economies through corporate networks and professional communities. Findings not only advance current debates on clusters, global services sourcing, and the geography of knowledge production, but also have important policy implications.

KEY WORDS:

Knowledge Services, Geographic Clusters, Co-evolution, Outsourcing, Global Value Chains, Global Race for Talent, Global Service Delivery Model, Brain Circulation, Globalization of Innovation and R&D

INTRODUCTION

Several scholars have recently engaged in a debate on the future role of geography in knowledge production (e.g. Malecki, 2010; Breschi and Malerba, 2001). Some have argued that the world is becoming more ‘flat’, i.e. location advantages are becoming less important (Friedman, 2005; Apte and Mason, 1995; Mithas and Whitaker, 2007). This is because costs of global communication and information transfer have decreased (e.g. Metters and Verma, 2008), and because knowledge work – understood as: symbolic-analytical work, which is traditionally performed by skilled professionals (Drucker, 1959; Reich, 2001) – is increasingly digitalized and modularized (Sinha and Van de Ven, 2005), making co-location less necessary (see e.g. Blinder, 2006). Other scholars have replied that the world remains ‘spiky’ (Florida, 2005; Ghemawat, 2011), noting that knowledge work remains unevenly distributed globally and that, despite digitalization and modularization, some locations attract more investments in knowledge-intensive operations, e.g. R&D centers, than others (e.g. Doh et al., 2009; Demirbag and Glaister, 2010; Liu et al., 2011). This conceptual article contributes to this debate by arguing that the geography of knowledge production is being shaped by a new type of spike or hub – so-called ‘knowledge services clusters’ – which have emerged primarily as a result of the increasing commoditization of knowledge work and related skills.

More concretely, recent studies suggest that new ‘Silicon Valleys’ have emerged in developing countries (Bresnahan et al., 2001; Saxenian, 2000) which seem to grow into important hubs of innovation (see also Malecki, 2010). For example, several Indian cities, such as Bangalore, Chennai and Pune, have become known for software services (Dossani and Kenney, 2007; Zaheer et al. 2009; Sonderegger and Taeube, 2010). As for R&D services, often mentioned locations include Beijing, Sao Paolo, Moscow and Bucharest (see e.g. GlobalServices, 2008). I will argue that these and other locations providing knowledge services indicate a larger phenomenon which I call the emergence of ‘knowledge services clusters’ (KSCs). I define these as geographic concentrations of lower-cost technical and analytical skills serving rising global demand for commoditized knowledge services. KSCs combine features of high-tech clusters (such as Silicon Valley, Route 128, or the Research Triangle in the U.S.), with features of low-cost manufacturing clusters in emerging economies, yet they also show some distinct characteristics: First, they develop around services, such as software development, simulation, testing and

CAD design, rather than particular technologies or products. Second, they serve global (rather than regional or local) clients *across* rather than *within* particular industries. This is because knowledge services are increasingly decoupled from end products or industry specifics, hence generating productivity gains for specialized service providers (Sako, 2006). This paper identifies key properties, drivers and contingencies of growth of KSCs, focusing on the role of service commoditization, sourcing preferences of multinational firms, global competitive dynamics, and linkages between KSCs and high-tech clusters. Although this is a conceptual paper, some empirical evidence will be provided, mainly from the Offshoring Research Network (ORN) – an international research initiative on recent trends of global services sourcing (Lewin and Couto, 2007).

This paper seeks to contribute to future research mainly in two ways. First, it advances our understanding of cluster emergence in a changing global economy. While previous research has either focused on high-tech clusters in developed countries (e.g. Porter, 2000; Iammarino and McCann, 2006) or on low-cost manufacturing clusters in developing countries (e.g. Altenburg and Meyer-Stamer, 1999; Humphrey and Schmitz, 2002), this paper discusses global sourcing of knowledge services as a relatively new, yet increasingly important driver of cluster emergence. Special emphasis will be placed on the ambivalent role of service commoditization as a promoter and constraint of cluster growth. Second, this paper contributes to the ongoing debate on the global re-organization of knowledge work, and the role of location in performing such work (Malecki, 2010). In line with recent research on location choice for R&D (e.g. Demirbag and Glaister, 2010), this paper confirms that location advantages persist despite advanced ICT and digitalization of knowledge work. Yet, it argues that in the case of KSCs potential location advantages are very contingent upon global competitive conditions and changing global sourcing practices. Related to this, extending previous studies on KSCs in particular in India (e.g. Arora et al., 2001; Dossani and Kenney, 2007; Athreye, 2005; Zaheer et al., 2009), this paper argues that the emergence of KSCs is not limited to India but becoming a global phenomenon.

First, the paper reviews traditional and recent research on clusters, with particular focus on the observation of ‘new Silicon Valleys’. Second, KSCs will be identified as a new cluster type combining features of, yet also being distinct from *both* high-tech clusters *and* low-cost manufacturing clusters. Third, major contingencies of cluster growth will be discussed within a changing global competitive space. Several hypotheses will be developed to inspire future research. The paper finishes with implications for current debates as well as cluster promotion and policy-making.

FROM THE ORIGINAL TO NEW ‘SILICON VALLEYS’: A BRIEF REVIEW

Clusters have often been defined as geographic agglomerations of firms that are more or less specialized and interconnected, and that typically belong to particular industry sectors (see e.g. Porter, 2000; Giuliani, 2005; Iammarino and McCann, 2006). One often cited definition was provided by Michael Porter (2000, p.15) according to whom clusters are “geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate”. The concept relates back to Marshall’s (1920) notion of industrial districts which are characterized by geographic concentrations of industry players, pools of readily available labor, and a knowledge base shared by a local community of firms and professionals. The existence of clusters has been explained by the unequal geographic distribution and spatial concentration of skills and expertise (Cooke, 2005; Iammarino and McCann, 2006), knowledge spill-over effects due to co-location of industry players and related specialization and agglomeration effects (Porter, 2000; Pouder and St. John, 1996; Feldman et al., 2005; Song et al., 2003).

Cluster research has traditionally focused on clusters in *developed countries* (see e.g. Iammarino and McCann, 2006): in particular specialized manufacturing clusters (see e.g. Porter, 1990; Piore and Sabel, 1984), and high-tech clusters (see e.g. Saxenian, 1994). In the context of this study, the category of high-tech clusters is particularly interesting. In general, high-tech clusters denote geographic concentrations of firms and related institutions in high-tech sectors, e.g. information and communication technology (ICT), nano technology, bio technology, optical technology and others. Silicon Valley is often mentioned as a 'prototype' high-tech cluster, in particular for ICT, nano and biotech (see e.g. Saxenian, 1994). Yet as a generic cluster form, many other high-tech clusters have been studied most of which are located in the U.S. or Western Europe: e.g. Boston / Route 128 for biotech (Saxenian, 1994; Powell et al., 1996); the Research Triangle in North Carolina for life sciences and medical technology (Feldman et al., 2005); Silicon Fen (Cambridge, UK) for software, electronics and biotech (Iammarino and McCann, 2006); OPTEC in Berlin-Brandenburg (Germany) and other photonics clusters in West Midlands (England) and Arizona (US) (Sydow et al., 2010, 2011). Common features of high-tech clusters include a local concentration of technology-specific expertise and talent; universities with related research and education programs; spin-off research institutes and entrepreneurial tech firms; R&D departments of major industry players; numerous research collaborations between firms and universities, and a vibrant community of highly skilled and highly paid tech professionals and university scientists (see e.g. Saxenian, 1994; Powell et al., 1996).

More recently, however, cluster research has increasingly recognized the emergence of clusters in *developing countries*. Most studies have thereby focused on low-cost manufacturing clusters – geographic concentrations of producers (typically sub-suppliers) of manufactured goods and components that are sold to original equipment manufacturers (OEMs) and/or distributors in Western economies. Examples include textiles and electronics manufacturing clusters in Latin America and China (Altenburg and Meyer-Stamer, 1999; Moreira, 2006; Jenkins et al., 2007); automotive production clusters in Eastern Europe, China and South Africa (Depner and Bathelt, 2005; Barnes and Morris, 2004). These clusters typically have in common a strong orientation towards global clients, and a large pool of low-cost, often low-skilled manual labor Western manufacturers utilize – either directly or through external suppliers – in order to cut production costs (see e.g. Mudambi, 2008). Because of their global orientation and dependence on Western client demand for low-cost labor, scholars have argued that low-cost manufacturing clusters in developing countries are important hubs in global value chains and production networks (Gereffi et al., 2005; Humphrey and Schmitz, 2002; Coe et al., 2008; Morrison et al., 2008; Levy, 2008).

The still dominant notion that high-tech clusters emerge mainly in developed countries, whereas low-cost manufacturing clusters emerge in developing countries reflects established practices of globally distributing value-adding activities. Whereas ‘high value-adding’ research and development (R&D) activities are retained at home (Edler et al., 2002) or within the TRIAD region, i.e. in North America/NAFTA, Western Europe and Japan (see e.g. Gassmann and von Zedtwitz, 1999; Kuemmerle, 1999; Florida, 1997; Gerybadze and Reger, 1999), ‘low value-adding’ manufacturing processes are performed in developing countries (e.g. Levy, 1995; Mudambi, 2008). This pattern however is changing, in particular as more R&D activities are being distributed globally *beyond* developed countries (see e.g. e.g. Ernst, 2002, 2005; Lewin et al., 2009; Malecki, 2010). Several scholars suggest that this trend has promoted the rise of new clusters in developing countries that seem to resemble high-tech clusters in the developed regions. One often given example is the ‘Silicon Valley of India’ – Bangalore, which has established a reputation for providing high-skilled software engineering and other IT-based knowledge services, e.g. computer-aided design, testing, and data mining, for global clients across industries (Saxenian, 2000; Bresnahan et al., 2001; Chaminade and Vang, 2008). However, many other cities demonstrate the increasing potential of developing countries to perform knowledge work, e.g. Pune, Hyderabad, and Chennai in India (see e.g. Arora et al., 2001; Dossani and Kenney, 2007; Zaheer at al., 2009); Beijing, Shanghai, and Hsinchu in China and Taiwan (Saxenian and Hsu, 2001; Gassmann and Han, 2004); Bucharest, Prague and St. Petersburg in Eastern Europe (e.g. GlobalServices, 2008); Recife (Brazil), Cordoba (Argentina) and Monterrey (Uruguay) in Latin America (Kesidou and Romijn, 2008; Manning et al., 2010).

This trend has sparked a debate among scholars and policy-makers to what extent these new geographic clusters are or can become ‘new Silicon Valleys’ by adopting typical features of high-tech clusters, or whether they substantially differ (see for this debate e.g. Bresnahan et al., 2001; Saxenian, 2005; Chaminade and Vang, 2008). I seek to contribute to this important debate by arguing that these new clusters constitute a new generic cluster form that I call 'knowledge services clusters' by combining features of both high-tech and low-cost manufacturing clusters, while also showing some distinct characteristics that affect their potential to emerge and grow. Later on, I discuss potential transitions between cluster types, in particular the potential of knowledge services clusters to grow into high-tech clusters.

KNOWLEDGE SERVICES CLUSTERS: KEY FEATURES AND DRIVERS

I define knowledge services clusters as geographic concentrations of lower-cost technical and analytical skills and expertise serving global demand for increasingly commoditized knowledge services. Below, I discuss major properties and drivers of this new and increasingly important cluster type. I thereby refer to multiple sources of empirical evidence I introduce in more detail next.

My primary data source is the Offshoring Research Network (ORN) – an international community of scholars studying the trend of offshoring, i.e. the sourcing of administrative and knowledge services from outside the home country in support of domestic and global operations (see also Manning et al., 2008; Kenney et al., 2009). Since its foundation in 2004, the ORN has conducted two major annual surveys: the corporate client survey and the service provider survey. The corporate client survey has collected data on global sourcing strategies, drivers, challenges, outcomes, and concrete implementations (see e.g. Lewin and Couto, 2007; Heijmen et al., 2009). As of 2010, the database included data from 485 U.S. firms and 880 European firms, based in various industries, primarily manufacturing, finance and insurance, software, and professional services. 37% of firms are large (> 20,000 employees); 36% are midsize (500 to 20,000 employees) and 27% are small (< 500 employees). The database includes data on 2,780 concrete offshore projects, defined as allocations of tasks or processes in particular locations outside the home country. Tasks may include: IT processes, administrative services (e.g. HR, legal, finance and accounting), call centers, and knowledge work. I focus on the latter. Figure 1 gives a breakdown of tasks included in this category, such as software development, engineering, product design, R&D, and analytical services.

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I also use data from the ORN service provider survey (since 2007). Survey participants include providers of various services such as IT services, call centers, administrative, and knowledge services (see Figure 1). As of 2010, this database contained data from 508 service providers based in different countries, including India, China, Western Europe and the U.S. 25% of providers are large (> 10,000 employees); 30% midsize (500-10,000 employees) and 44% small (<500 employees). Among other things, the survey provides information on types of services offered, service delivery locations, risks as perceived by providers, types of clients served, and a range of performance data.

Apart from the ORN surveys, I also build on findings from a number of empirical studies on location choice patterns in services sourcing (e.g. Doh et al., 2009); the emergence of regional service capabilities targeting global demand (e.g. Athreye, 2005; Ethiraj et al., 2005); the evolution of client sourcing capabilities (e.g. Levina and Vaast, 2008; Kumar et al., 2009; Vlaar et al., 2008); and the emergence of globally spanning professional networks and communities (see e.g. Zaheer et al., 2009; Saxenian, 2005; Sonderegger and Taeube, 2010).

One major finding of the ORN project and other studies is that sourcing of knowledge work (see Figure 1) is an increasingly global phenomenon. Not only do firms from the U.S. and Western Europe in particular increasingly source knowledge work from abroad (see e.g. Lewin et al., 2009; Massini and Miozzo, 2012), but the number of locations from which knowledge work is sourced from has increased as well (e.g. King, 2006). Figure 2 illustrates this trend. It shows based on ORN data the share of knowledge work being sourced from different regions in different time periods (U.S. firms only). Whereas prior to 2002 most offshore projects related to knowledge work were sourced from India, in particular from cities such as Bangalore, Pune, and Hyderabad (see also Arora et al., 2001; Dossani and Kenney, 2007), over time a growing number of countries have attracted knowledge services sourcing projects. Although the total number of projects going to India has been growing, the market share of India compared to other sourcing locations has been decreasing (see also Heijmen et al., 2009). Today, a growing number of projects is sourced from cities in China (e.g. Beijing, Shenzhen), Eastern Europe (e.g. Bucharest, Prague, St Petersburg), Latin America (e.g. Sao Paolo, Cordoba), and even Africa (e.g. Cairo) (see also ATKearney, 2004; GlobalServices, 2008). Table 1 lists a number of emerging clusters for providing business analytics, engineering services, and research and development based on the GlobalServices (2008) study.

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These clusters – which I refer to as knowledge services clusters (KSCs) – combine certain features of, yet are also distinct from both high-tech clusters and low-cost manufacturing clusters (see for a comparison Table 2). In particular, they have two major properties that I explain in detail next: (1) the availability of lower-cost technical and analytical skills and service capabilities, and (2) a strong orientation to global rather than just local or regional demand for such skills and capabilities across industries. .

Firstly, KSCs develop around the local availability of lower-cost technical and analytical skills and service capabilities. Unlike in the case of manual work and manufacturing, the symbolic-analytical and partially intangible nature of knowledge work typically requires higher-skilled professional expertise to perform such work (Drucker, 1959; Reich, 2001). Therefore, similar to high-tech clusters, KSCs are likely to develop around technical universities producing young technical and analytical talent on a regular basis (see Table 2; see also Chaminade and Vang, 2008; Manning et al., 2012). However, compared to high-tech clusters in Western economies, salaries of tech professionals in KSCs remain relatively low on average. For example, annual salaries in Indian KSCs range from $15-20k, compared to over $100k in Silicon Valley (Payscale, 2012; Tam, 2012). Importantly, while wages, e.g. in India, have been rising in recent years (see e.g. Farrell et al., 2005), salaries in high-tech clusters have increased as well – the *relative* difference therefore remains quite significant (see also Kenney et al., 2009).

Also, unlike in high-tech clusters, universities in KSCs typically do not engage in sophisticated research collaborations with local and foreign firms (see e.g. Chaminade and Vang, 2008). The latter rather use local universities as low-cost talent providers (see e.g. Basant, 2006; Saxenian, 2005; Manning et al., 2012). This, along with the lack of intellectual property protection, has often been interpreted as a major weakness of emerging clusters in developing countries (e.g. Chaminade & Vang, 2008). In contrast, I argue that KSCs have been able to emerge and attract foreign investment *despite* these apparent limitations. As I explain in more detail below, the main reason is the increasing commoditization of knowledge work which allows foreign firms to utilize (lower-cost) local S&E graduates at various skill levels, and which justifies growth of local R&D operations without sophisticated R&D collaborations with local universities. To illustrate, in their study of an engineering services cluster in Romania, Manning et al. (2012) show how the local technical university adopted the role of a 'talent provider' to foreign, in particular German, client firms. However, the university's attempts to initiate R&D collaborations with one major MNC client in particular have been blocked, not only because the university was lacking research expertise (compared to German universities this MNC already worked with), but because the idea of engaging in R&D collaboration conflicted with the low-cost sourcing imperative of this MNC. Yet, *despite* these limitations, the cluster has been able to grow – as a KSC rather than a high-tech cluster – by attracting foreign investments in engineering support facilities (Manning et al., 2012). Notably, some KSCs, e.g. Bangalore and Beijing, have started building deeper university-industry R&D linkages (see e.g. Chaminade and Vang, 2008) which I discuss later on as an important condition for KSCs to transition into high-tech clusters.

The second related major feature of KSCs is their strong orientation towards and dependence on global rather than just local or regional demand for knowledge services, often across industries. Prior research shows that the initial growth of many high-tech clusters in Western economies, such as the Berlin-Brandenburg optical technology cluster (Germany) or Silicon Valley (U.S.), is often stimulated by a strong regional and/or domestic demand for particular technologies (see e.g. Sydow et al., 2010, 2011; Saxenian, 1994; Porter, 1990). By contrast, KSCs in developing countries typically show a strong global client orientation from the very beginning, not least because of initially lacking domestic and regional demand for knowledge services (see e.g. Saxenian, 2000; Basant, 2006; Chaminade and Vang, 2008). Correspondingly, knowledge service providers based in emerging economies mainly target overseas rather than domestic clients (see e.g. Arora et al., 2001). Also, early foreign MNC investment in KSCs, such as Texas Instruments in Bangalore (Basant, 2006) or Motorola in Cordoba (Manning et al., 2010), is primarily aimed at supporting global operations rather than regional markets. The global orientation of KSCs is a feature they share with low-cost manufacturing clusters (see also Table 1). However, whereas manufacturing clusters typically specialize in providing components for particular products (e.g. electronics, cars, clothing), KSCs provide services, e.g. analytical services and software testing,, that are in demand across industries and decoupled from particular end products (see also Sako, 2006). In this sense, KSCs are also different from high-tech clusters which typically develop technology and industry-specific expertise, e.g. biotech or optical technology, whereas KSCs specialize in providing process knowledge, which can be applied across product value chains and industry contexts (see also Sako, 2006; Saxenian, 2000).

The emergence of KSCs as a generic cluster type can be explained mainly by three related trends: the commoditization of knowledge work in conjunction with the use of advanced information and communication technology (ICT); the increasing demand for advanced, yet lower-cost technical and analytical skills; and the increasing supply of knowledge services by external providers in conjunction with national policies promoting such services. I will discuss each driver in more detail next.

First, many authors have argued that offshoring of technical services is driven by the advancement of ICT which has decreased costs of long-distance communication and coordination (e.g. Metters and Verma, 2008), and facilitated the disintermediation of processes and tasks (see e.g. Mithas and Whitaker, 2007; Apte and Mason, 1995). Over time, this has promoted an increasing commoditization of knowledge work (see Figure 3). Commoditization refers to the process of modularizing, standardizing and decoupling services from particular uses which increases the feasibility of sourcing such services from specialized captive service centers or external providers (see also Davenport, 2005; Baldwin and Clark, 2000). Figure 3 reports, based on ORN data, the degree to which service providers perceive knowledge services (e.g. engineering support, product design and R&D) to be highly commoditized. It compares perceptions in 2007, 2009 and in the near future (based on the 2009 survey). Figure 3 indicates an increasing overall trend towards commoditization of knowledge work. Importantly, this not only means that the provision of knowledge services, such as engineering tests and computer-aided design, becomes less costly, but that MNC captive units and external service providers may develop service capabilities quite independent from particular products. Over time, service capabilities can be customized, e.g. by applying different product specifications, to various internal and external client needs, thereby generating economies of scale and scope (see also Sako, 2006). Prior studies suggest that service providers have actively promoted service commoditization by educating clients about cost advantages of using standardized vs. more idiosyncratic processes (see e.g. Ethiraj et al., 2005; Metters and Verma, 2008). The recent trend of legal services outsourcing is an example of supplier-driven commoditization (Lewin and Russell, 2009). This, in turn, has promoted geographic clustering of such services, as both MNC captive units and service providers benefit from local concentration of service-related skills and knowledge spillover effects across firms (see also Song et al., 2003; Almeida and Kogut, 1999).

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Second, the emergence of KSCs has been promoted by the increasing demand of client firms, mainly from developed countries, for highly skilled, yet lower cost technical and analytical professionals to perform increasingly commoditized knowledge work. In the offshoring literature, there has been an ideological divide between scholars proposing that offshoring of services (including knowledge services) has been mainly driven by labor cost advantages (see Levy, 2005; Doh, 2005), and scholars proposing that it has been driven by the need for highly skilled talent (and talent shortages at home) (see e.g. Lewin et al., 2009). Addressing the second view, some scholars have made the puzzling observation that the actual level of qualification of many graduates in engineering, science and analytics in China and India is often lower than their counterparts' in the U.S. and Western Europe (see e.g. Gereffi et al., 2008). Despite this 'constraint', however, firms seem to continue to hire young professionals offshore. The main reason is that both client firms and service providers have managed to fine-slice and 'commoditize' knowledge work, using advanced ICT (see above), and to utilize sufficiently skilled professionals at lower costs (Kenney et al., 2009; Jensen and Pedersen, 2011), even if their qualifications are not equivalent to 'Western standards' (Gereffi et al., 2008). Correspondingly, ORN data suggests that firms select offshore locations based on the combined availability of domain-level expertise and talent pools, *and* low labor costs (see Figure 4). This, again, shows that KSCs are selected for different reasons than high-tech or low-cost manufacturing clusters (see above).

Third, the emergence of KSCs is also a consequence of the growing service provider industry (see e.g. Couto et al., 2008) and the role of national policies promoting the development of such industries, such as software services in India (see e.g. Heeks, 1996; Arora et al., 2001; Reddy, 1997). Well-known service providers today include IBM and Accenture from the U.S., and Wipro, Infosys, GenPact and Tata from India. Service providers like these have not only contributed to the increasing commoditization of services and the growing demand for such services from clients based in Western economies in particular (Metters and Verma, 2008), but they have also attracted a growing volume of offshore projects to emerging economies, using large numbers of mostly young S&E professionals. Thereby, vendors have benefitted from using 'portable skills' (Dossani and Kenney, 2007) and 'reusable' components or pieces of code (Basant, 2006) that can be applied to provide generic, rather than product or industry-specific business services to a range of client firms across industries (Sako, 2006). In recent years, service providers – not least from emerging economies – have further started to internationalize their operations by setting up nearshore service delivery hubs to better serve key clients (Niosi and Tschang, 2009). These hubs are integrated into global service delivery networks which help providers increase speed of service delivery by bridging and exploiting time zone differences to client locations (Govindarajan.and Ramamurti, 2011). This has also promoted the rise of numerous second-tier KSCs in recent years, e.g. in North Africa and Central America, serving European and U.S. clients (see also Lewin et al., 2011; Manning et al., 2010).

CONTINGENCIES OF CLUSTER GROWTH AND ATTRACTIVENESS

Above, I discussed generic properties and drivers of KSCs as a cluster form. In this section, I focus on some major contingencies of cluster growth and attractiveness, and elaborate why *particular* KSCs may be more effective than others in attracting global client projects over time. Like low-cost manufacturing clusters, KSCs compete for client projects in a highly competitive global sourcing space. In the case of manufacturing, for example, many electronics clusters in Latin America have faced increasing low-cost competition from China in recent years which arguably led to their decline (Moreira, 2006; Jenkins et al., 2007). Because of the similarly strong global orientation of KSCs, it is important to investigate why certain KSCs are more likely than others to grow and sustain under conditions of global competition. I define cluster growth in terms of the ability of clusters to continuously attract client projects generating jobs and sales for service providers as well as for MNC captive units located in the cluster.

I thereby focus on *global* contingencies of cluster growth to counterbalance the tendency of cluster studies to exclusively look at local or regional drivers of growth while neglecting global conditions. The region-centric view of many cluster studies can be explained by the initially strong domestic orientation of particularly Western industry clusters. For example, many studies have focused on the role of cluster promotion policies (see e.g. Saxenian, 1994, 2000), local entrepreneurship (e.g. Feldman et al., 2005; Parthasarathy and Aoyama, 2006), sophistication of regional or domestic demand (Porter, 1990); and cluster leadership (Sydow et al., 2011). Relatedly, scholars have discussed knowledge spillover effects and competition for innovation as drivers of cluster growth (Porter, 2000), but also ‘diseconomies of agglomeration’ (Pouder and St. John, 1996), e.g. due to growing competition for local resources.

Notably, many of these factors have shown to be equally important for KSCs. For example, prior studies have emphasized the role of local government policies and institutions in promoting KSC growth, e.g. the launch of the business association NASSCOM, tax-friendly business parks and government promotion of software firms in the case of Bangalore and Hyderabad (e.g. Dossani and Kenney, 2007; Saxenian, 2000; Basant, 2006; Heeks, 1996). Similarly, in the case of Recife, Brazil, the set-up of Porto Digital – a business park for IT firms – was key for attracting local and foreign businesses (Manning et al., 2010); In China, government-led investments in business campuses in major cities have been major growth drivers (Gassmann and Han, 2004). However, at the same time, authors have argued that in many cases such initiatives were effective not because of domestic demand, but because local enterprises were export-oriented, and because foreign firms got attracted to the regional skill pool, partly through existing business linkages (e.g. Basant, 2006; Chaminade and Vang, 2008). In line with prior studies (e.g. Patibandla and Petersen, 2002). I will therefore focus on the *interrelation* between local and global conditions in promoting the growth of certain KSCs rather than others. In particular, I discuss the ambivalent effect of commoditization of services; global client preferences; and linkages with client economies.

(1) THE AMBIVALENT ROLE OF SERVICE COMMODITIZATION

Earlier I argued that increasing commoditization of knowledge work has promoted the rise of KSCs worldwide. When looking at the development of *particular* clusters however the role of commoditization is quite ambivalent. With regard to global service providers, Sako (2006) made the argument that both standardization and customization of services are important ingredients of productivity gains and scale economies on the provider side. This is because standardization allows selling the same service to multiple clients (across industries), whereas customization allows selling multiple services to the same client. Other studies show accordingly that making client-specific investments *across* services – despite high degree of standardization of any particular service – allows providers to build long-term relationships with global clients (Manning et al., 2011). I now make a similar argument with regard to KSCs.

On the one hand, a high degree of commoditization of services, e.g. software and engineering support services, may generate high client demand across industries which, in turn, helps generate scale and scope economies in KSCs providing such services. However, location switching costs decrease for clients as well, since other KSCs may provide similar services and skills, which, in turn, increases competitive pressure on any particular cluster. Case evidence suggests that more and more client firms develop capabilities that allow them to flexibly shift operations from one location to another, e.g. in case of unstable political conditions, increasing operational costs or service disruptions. For example, FND (a midsize software company, name changed) recently shifted IT tech support from their Cairo center to Canada, in response to the political uprising in Egypt.

Unlike manufacturing, IT-based service operations, such as tech support, can be easily relocated across distances without much friction. Because of this flexibility, highly commoditized service operations are very vulnerable to relocation in case alternative locations offer more favourable economic and/or institutional conditions.

On the other hand, unlike high-tech clusters, KSCs benefit only to some degree from specificity. In the case of high-tech clusters, skill sets serving highly specific client demands may help develop a distinct competitive advantage due to high imitation barriers (see Porter, 1990, 2000). However, in the case of KSCs, high specificity of knowledge services involves considerable disadvantages. Most importantly, high product or client specificity of services and skills available in a KSC may decrease the likelihood that local service capabilities can be exploited beyond particular applications. For example, the success of service providers, such as Infosys, has relied on their ability to apply service-level expertise *across* clients from different industries, thereby generating economies of scale and scope. Unlike high-tech clusters, whose success depends on highly specific expertise in technologies for end users in particular industries (e.g. biotech or optical technologies), KSCs typically provide more generic, often low-value adding knowledge services, e.g. engineering tests, which feed into globally dispersed R&D client operations. As a relatively low-margin business (compared to end-user technology development), knowledge services generate revenue only if they can be decoupled from particular uses and applied to various global client demands – sometimes within (larger) industries (e.g. automotive engineering; see Manning et al., 2012), but often across industry contexts (e.g. software development and analytical services; see e.g. Sako, 2006).

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INSERT FIGURE 5

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Therefore, I propose that KSCs are more likely to grow and continuously attract client projects within a global competitive space if the level of service commoditization is medium. In other words, it should allow for a sufficiently high volume of transactions and projects, while also generating some distinctiveness which lowers the threat of imitation and increases relocation costs for businesses operating in these clusters (see Figure 5). One example of 'medium' commoditization is the provision of tech support to clients in the same time zone. While tech support can be highly commoditized, time zone proximity allows more immediate service and narrows down location options for clients demanding such service. Another example are high levels of service capability *within* a recognized standard system, such as the capability maturity model (CMM) for software development (see e.g. Arora, 1999; Ethiraj et al., 2005). Prior studies show that clusters where CMM has been adopted by local vendors, e.g. Cordoba, have been more successful in attracting client projects than clusters where regional standards have dominated, e.g. in Guadalajara (see Manning et al., 2010). A third example are language capabilities which add value to certain clients *across* standardized services. I therefore propose:

> **HYPOTHESIS 1: KSCs are more likely to continuously attract client projects if the level of service commoditization is medium. Both very low and very high degrees of service commoditization will decrease the attractiveness of a KSC providing such services.**

(2) GLOBAL CLIENT PREFERENCES AND LOCAL RESOURCES

As discussed earlier, the rise of KSCs can be partly explained by the increasing ability of global clients to utilize sufficiently skilled technical personnel from abroad at relatively low costs to perform commoditized knowledge work (Kenney et al., 2009; Freeman, 2006). This implies that, unlike in the case of high-tech clusters in developed countries, foreign firms select KSCs in developing countries not just because of perceived skills available, but because they expect (at least initially) a labor cost advantage vis-à-vis providing these services at home (see Figure 4; Saxenian, 2000). Figure 6 makes this point clear: It distinguishes location choices of client firms by the importance of 'saving labor costs' in their sourcing decisions. It shows that U.S. or Western European locations are selected for sourcing knowledge work primarily if saving labor costs is *not* an important driver, whereas locations in India, China or Eastern Europe are selected more frequently if costs *are* important. Importantly, according to ORN data, the vast majority of sourcing projects have gone to one of these regions, rather than the U.S. or Western Europe, in the last ten years, which demonstrates the importance of cost.

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INSERT FIGURE 6

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Yet, unlike in the case of low-cost manufacturing clusters, low labor costs are never sufficient as a driver to select a particular KSC. Rather, because of qualified personnel needed to perform knowledge work, available skill levels, including technical and language skills, are perceived to be as important in selecting a location (see also Lewin and Couto, 2007; GlobalServices, 2008). Correspondingly, those countries (and cities) attracting most sourcing projects typically *combine* both characteristics: perceived availability of highly qualified personnel *and* labor cost advantages (Lewin and Couto, 2007). Importantly, although some scholars have suggested that labor arbitrage effects have become less critical for sourcing knowledge-intensive work (see e.g. Lewin et al., 2009), empirical data also shows that foreign firms have become increasingly concerned with wage inflation and high employee turnover in certain hotspots, such as Bangalore or Shanghai (Gassmann and Han, 2004; King, 2006) which has led to a shift to 'second-tier' locations (see e.g. Manning et al., 2010, 2012). This indicates that cost considerations continue to be important. I therefore hypothesize:

> **HYPOTHESIS 2: KSCs are more likely to continuously attract client projects if both the availability of relevant skills** *and* **labor cost advantages are perceived to be comparatively high.**

Yet, many studies also suggest that despite the growing availability of alternative locations for sourcing knowledge work (see e.g. GlobalServices, 2008), many firms continue to source knowledge work from particular hotspots, thereby further increasing local competition for talent and decreasing cost benefits. While this can be partly explained by well-known agglomeration or band-waggon effects in combination with (tolerated) diseconomies of agglomeration characterizing clusters (Pouder and St John, 1996), there are additional reasons for this phenomenon.

KSCs in developing countries are typically very distant from client firms' home countries, not just geographically, but also in terms of their economic and institutional conditions (see also Saxenian, 2000). This is partly a result of the strategic imperative of Western firms to exploit economically favourable *differences* (rather than similarities) between offshore locations and home countries (e.g. lower labor costs, lax institutional regulations etc.), thereby accepting often considerable operational risks (Hahn et al., 2009). As part of that, many firms are little familiar and lack direct experience with KSC location conditions before making location choices. By contrast, market-seeking foreign investments are typically based on a gradual learning process of operating in increasingly distant or different regions (Johansen and Vahlne, 1977; Rugman and Verbeke, 2004). Similarly, many firms investing in high-tech clusters often come from economies with similar legal systems and financial infrastructures (see e.g. Liu et al., 2011).

By contrast, location choices for sourcing knowledge services are often made based on very little prior location expertise. For this reason, orientation at peer firms, in particular industry leaders from the same country, becomes a critical source of trust. Several studies confirm that only after the arrival of pioneer MNCs from the U.S. or Western Europe, locations begin to become attractive destinations for offshore projects (see e.g. Patibandla and Petersen, 2002; Dossani and Kenney, 2007). Examples include IBM, HP and Texas Instruments in India (e.g. Reddy, 1997; Basant, 2006), or Motorola in Argentina and Brazil (Manning et al., 2010). The arrival of pioneer MNCs indicates to peers that local business conditions are favourable (and trustable), not least because local administrations and universities learn – through pioneer MNCs – how to serve foreign client demands. This also helps KSCs 'specialize' in serving particular client economies. Saxenian (2000) gives the example of Texas Instruments taking numerous bureaucratic hurdles to set up a satellite link in Bangalore which persuaded other U.S clients to follow. Manning et al. (2012) describes how a German MNC turns a Romanian university into an engineering talent provider attracting other German MNCs.

At the same time, location choices of pioneer MNCs may lead to the exclusion of *other* locations from consideration by peers – despite often similarly favourable skills and cost conditions. One example is the role of Motorola in attracting offshore projects to particular cities in Latin America, e.g. Cordoba and Recife, rather than others, e.g.

Guadalajara (see Manning et al., 2010). While all three cities developed fairly similar IT and software services capabilities in the 1990s, Cordoba and Recife ended up attracting more offshore projects. One reason was that the first MNC recruiting initiative in Guadalajara happened in the early 2000s when India was getting most attention by MNCs, whereas Recife recruited when U.S. MNCs started looking for alternatives to India. The other reason, however, was that Motorola set up offshore operations in Cordoba and Recife, which has attracted other, in particular U.S., firms. Among other things, Motorola also promoted the diffusion of CMM standards at these locations which has arguably increased their attractiveness (see above). I therefore hypothesize:

> **HYPOTHESIS 3: KSCs are more likely to continuously attract client projects (from particular countries) if multinational lead firms (from these countries) are present in these KSCs.**

However, despite the importance of Western client MNCs – and increasingly also global service providers (see Niosi and Tschang, 2009) – the ability of KSCs to grow and compete also depends on the presence of local entrepreneurial service providers. The main contribution of MNCs – beside concrete sourcing projects – is the transfer of global sourcing practices and standards, such as CMM certification (Arora, 1999; Patibandla and Petersen, 2002) and collaborative programs with local universities (Manning et al., 2012), which helps locations become globally recognized as KSCs. Yet, overreliance on MNCs makes KSCs vulnerable to global competition from other similar MNC hubs, not least because MNCs have developed the ability to flexibly shift operations between locations (see above). Because of this risk the mixed presence of both global players and local providers is more likely to support sustained growth. Prior studies show that small providers are more likely to provide more specialized, customized knowledge services, such as software development (Couto et al., 2008), thereby serving a market segment that large global providers, such as IBM, Accenture or Infosys, often do not cover. In fact, large providers often use small vendors as sub-suppliers for particular client requests (Basant, 2006). At the same time, small local vendors benefit from interactions with global clients (and large providers) to adapt their services to global markets (Madon and Sahay, 2001). Over time, this allows them to grow and internationalize themselves, whereby they typically retain their home city as a central hub for global operations. The recent internationalization of Indian providers is a good example (Niosi and Tschang, 2009; Govindarajan and Ramamurti, 2011). I therefore hypothesize:

> **HYPOTHESIS 4: KSCs are more likely to continuously attract client projects if both globally operating MNCs (clients and/or providers) and local entrepreneurial providers are located in that cluster. Dominance of either global or local players will lower the attractiveness of a KSC.**

(3) CLUSTER CONNECTIVITY WITH CLIENT ECONOMIES

Prior studies show that clusters in developing countries are often deeply interconnected, in terms of economic and personnel exchanges, with clusters in developed countries (see e.g. Bresnahan et al., 2001; Saxenian, 2005; Saxenian and Hsu, 2001). MNCs thereby play an important role by setting up and connecting hubs in different locations (Enright, 2000; Yeung, 2009). Another important form of connection – in case of manufacturing clusters – are global value chains or production networks which often span firm boundaries and which connect suppliers of raw materials and intermediate products typically located in lower-cost countries with global clients in more developed economies (see Gereffi et al., 2005; Levy, 2008; Humphrey and Schmitz, 2002; Coe et al., 2008; Chaminade and Vang, 2008). A similar dynamic can be predicted to also influence the attractiveness of particular KSCs.

First of all, KSCs establish outside connections through local units of MNC client firms and, increasingly, global service providers both from Western and emerging economies (Couto et al., 2008; Niosi and Tschang, 2008). While client MNCs typically use captive operations in KSCs to perform particular services, e.g. tech support, software design, or engineering tests, in support of domestic and global operations, providers increasingly set up units in different KSCs to expand global service delivery networks in support of global clients. As a result, KSCs become highly interconnected with client economies and other clusters.. However, unlike low-cost manufacturing clusters, which are typically integrated within product-or industry specific global value chains (see e.g. Nadvi and Halder, 2005), KSCs often support client operations *across* product value chains. This is because many knowledge services are aligned with corporate functions, such as IT and technology development (Porter, 1985), which provide resources across rather than within particular product lines (Sako, 2006). This implies that strong ties of KSCs with large, differentiated client economies, such as U.S. and Germany, are more likely to promote KSC growth than connections with globally dispersed clients in particular industries (see e.g. for the case of Indian clusters, Basant, 2006).

To illustrate, the decision of Cisco to set up a second headquarter in Bangalore including various R&D activities serving the Asian and global market has significantly driven the expansion of local firm operations (see also Gupta et al., 2008). In 2009, Cisco was planning to staff up to 10,000 employees in Bangalore, and the increasing connectedness of Bangalore operations with different product units is likely to further strengthen their local commitment (SiliconIndia, 2009). Another example is Bangalore - based Infosys which uses resources in Indian locations as part of their global delivery model of service provision to global clients. In this model, nearshore agents in the U.S. and Western Europe coordinate client projects, while offshore teams in Indian locations in particular specialize in delivering a variety of services to different client teams (see also Govindarajan and Ramamurti, 2011). As a result, connectivity of offshore teams with major client economies increase resulting in synergy effects which are difficult to establish in potential alternative locations. By contrast, offshore units that are more peripheral in corporate support networks are more prone to closure once local conditions turn less favourable. I therefore hypothesize:

> **HYPOTHESIS 5: KSCs are more likely to continuously attract client projects if service units in a particular cluster are highly connected to operations in large and differentiated client economies.**

Connections to client economies are also supported through interpersonal ties (Saxenian, 2005; Zaheer et al., 2009). Prior studies suggest that the diaspora of Indian engineers to the U.S. – and their return back to India – became an important foundation for start-ups in India, as well as for inter-linkages between Indian firms and Western clients (Bresnahan et al., 2001; Riddle et al., 2010; Sonderegger and Taeube, 2010). For instance, in 2000, 71 out of 75 MNCs in Bangalore’s software technology park were headed by Indians with work experience overseas, especially U.S. (Saxenian, 2000). Another example are German MNC operations in Shanghai which are often staffed by Chinese engineers with work and study experience in Germany (Manning et al., 2012). More generally, whereas high-tech clusters in Western economies have traditionally relied on *local* professional communities and knowledge spillovers effects (e.g. Saxenian, 1994; Song et al., 2003; Almeida and Kogut, 1999), for KSCs *global* community links seem particularly important. These linkages may promote what Saxenian (2005) calls ‘brain circulation’ – the transfer and adaptation of practices, knowledge and business opportunities to KSCs (see Tung, 2008; Saxenian and Hsu, 2001). The importance of these exchanges have also been recognized by venture capital firms (VCs). Dossani and Kenney (2007) give the example of a VC firm that promoted the business idea of a Silicon Valley based software firm (Hellosoft) to concentrate large parts of R&D in Hyderabad to exploit low-cost technical skills while benefitting from market access in the U.S. Not surprisingly, in 2002, the Indian Venture Capital Association founded a ‘Silicon Valley Chapter’ to support businesses linkages with Silicon Valley (Basant, 2006).

From this follows that the connectedness of the local professional community to communities in client economies worldwide – either within MNCs corporate networks or in broader diaspora networks (Riddle et al., 2010) – promotes local business ventures in support of global clients, and also enriches the pool of local expertise, which, in turn, increases location attractiveness for global sourcing projects. I hypothesize:

> **HYPOTHESIS 6: KSCs are more likely to continuously attract client projects if local professional communities are highly connected, in terms of personal ties, to client economies, in particular to high-tech clusters.**

DISCUSSION AND IMPLICATIONS

This study has examined the emergence of an important new form of geographic cluster that is currently changing the geography of knowledge production: knowledge services clusters (KSCs). I defined KSCs as geographic concentrations of lower-cost technical and analytical skills serving global demand for increasingly commoditized knowledge services, including software development, engineering support, product design, and analytics. KSCs thereby combine certain features of high-tech clusters (e.g. availability of high-skilled talent, existence of technical universities, specialization in knowledge work), and low-cost manufacturing clusters (e.g. low cost of labor, orientation to global demand, emergence in developing countries) (see Table 2). Drivers of the emergence of KSCs as a cluster form include the increasing commoditization of knowledge work; the growing demand of MNCs for high-skilled, yet lower cost science and engineering talent; and the growing supply of knowledge services by specialized providers.

I further discussed various contingencies affecting the growth and attractiveness of *particular* KSCs (rather than others) under conditions of global competition. I suggest that KSCs will attract most sourcing projects in the long run if the level of service commoditization is medium. This is because a very low level of commoditization narrows the applicability of services and increases dependence on particular clients (hence limiting growth); in turn, a very high level of commoditization increases competitive pressure from other locations and decreases switching costs for global clients (hence limiting growth). I also suggest that sustained attractiveness of KSCs will depend on the perceived availability of high-skilled talent at relatively low costs (rather than any one of the two features alone). The presence of lead foreign firms and entrepreneurial local vendors is another important condition for sustained competitiveness. Finally, I point out that strong connections of captive and outsourced service units in KSCs with operations in large and differentiated client economies will generate economies of scale and scope, and help attract projects to particular KSCs. Likewise, connections of the local professional community with high-tech clusters in client economies will increase the attractiveness of the local talent pool to global clients.

This has important implications for future research on clusters. First, unlike many region-centered studies on cluster development (e.g. Feldman et al., 2005; Saxenian, 1994), this study stresses the importance of global contingencies for the attractiveness of KSCs at particular points in time. It shows for example how location selection patterns of MNCs significantly affect cluster growth opportunities, as does global competition with clusters offering similar services. Future research has to focus much more on such global contingencies to understand the emergence of new 'spikes' in a globalizing economy (Florida, 2005). Second, the established idea that clusters are part of global value chains (see e.g. Humphrey and Schmitz, 2002) needs to be refined. Although this notion might be applicable to low-cost manufacturing clusters, KSCs should be rather thought of as the nexus of global service delivery networks quite independent from particular products or industries. In Porter's (1985) terminology, many services provided by KSCs support secondary value-adding activities that can often not be attributed to particular products, but to the overall operational efficiency and flexibility of firms (see also Sako, 2006). New concepts, such as 'connectivity' to global client operations and other clusters, may be needed to capture this trend. Third, findings prompt to rethinking the role of geography in knowledge production. As knowledge work becomes more fragmented, the notion that 'R&D' or 'innovation' is increasingly being outsourced or offshored (see e.g. Lewin et al., 2009; Nieto and Rodriguez, 2011; Demirbag and Glaister, 2010) requires some more thinking. Rather than being relocated entirely, innovation processes are being re-distributed across locations through fine-slicing and (re-)bundling of commoditized knowledge services, such as CAD and software testing (see also Jensen and Pedersen, 2011). Therefore, many 'spikes' in today's global economy might not necessarily boast the development of new products or technologies (Florida, 2005; Breschi and Malerba, 2001). Rather their importance lies in providing an increasing scale and scope of services in *support* of product development. Fourth, and relatedly, KSC firms seem to compete for process rather than product innovation by developing new service capabilities, including global delivery models (Ethiraj et al., 2005). These process innovations, however, are not necessarily bound to particular locations, but they co-evolve with the global expansion of service providers who build up service capacities around the world (Govindarajan and Ramamurti, 2011). This may promote further global distribution of knowledge work and related skills rather than a local concentration of capability development.

This study also has important implications for cluster policies and 'upgrading'. First of all, because of commoditization of knowledge work; growing global demand for related services and (low-cost) skills; and rather limited need for capital investment and institutional support structures (compared to high-tech clusters), the number of KSCs is likely to increase. Prior studies show that effective cluster policies include the promotion of export-oriented local service providers, and recruiting pioneer MNCs that can attract peers, in particular from the same country, by establishing recognized service standards and by customizing local conditions to their particular needs (see e.g. Patibandla and Petersen, 2002; Dossani and Kenney, 2007; Manning et al., 2012). Also, global service providers are expected to become increasingly important targets for cluster promotion as they internationalize operations. At the same time, policy-makers need to realize how location features (e.g. language availability, time zone) may add value to particular clients – thereby balancing the need for service commoditization and client customization. Based on that principle, chances of developing cities into at least small-scale second-tier KSCs are relatively high (compared to high-tech clusters). For example, in recent years, KSCs have emerged even in Africa (e.g. Egypt, Tanzania, Kenya), not least through the expansion of global service providers who benefit from Africa's time zone proximity to European clients (see e.g. ORN, 2011). Although Africa, according to ORN data, attracts only around 2% of global sourcing projects (as of 2010), this example cannot be stressed enough. With the exception of South Africa, Africa has not been able to grow a significant manufacturing base, not to mention high-tech clusters. Yet, with an enhanced ICT infrastructure and a usable skill pool, the growing demand for low-cost knowledge services has put Africa in an unprecedented position to compete with other developing regions. To what extent, however, particular KSCs can grow and/or last longer-term – given increasing global competition – is an important empirical question.

Because of global competitive dynamics, potentials for cluster upgrading are also important. Prior studies, first of all, indicate that low-cost manufacturing clusters, in particular those specializing in automotive production or electronics, may upgrade to KSCs, e.g. by adding engineering support skills, which benefit MNCs with already established local production facilities (see e.g. Altenburg et al., 2008). However, KSCs may also develop without prior related manufacturing experience (see e.g. Manning et al., 2012). Over time, KSCs may also advance to high-tech clusters. This however seems to depend on various factors. First of all, whereas KSCs only require a low level of local integration of businesses to attract client projects – e.g. foreign MNC units typically do not link up with local suppliers, but only with local universities for talent supply (e.g. Manning et al., 2012) – high-tech clusters, such as Silicon Valley, typically show a high level of local integration of businesses and institutions (see e.g. Saxenian, 1994). Chaminade and Vang (2008) therefore argue that Bangalore, for example, needs to develop a more integrated regional innovation system, including R&D collaborations and technology transfer between firms and universities, in order to become a high-tech cluster. In fact, growing R&D activities in bio-tech and deeper R&D ties with universities point in this direction (Basant, 2006). Supportive patenting and intellectual property regimes are important facilitators in this process (e.g. Malecki, 2010). Second, and relatedly, growth strategies of locally present MNCs may facilitate upgrading. For example, Cisco's decision to use Bangalore as a second headquarter was partly motivated by their strategy to establish an R&D hub for penetrating the growing Asian market (see e.g. Gupta et al., 2008). The coupling of sourcing and market-seeking R&D strategies of incoming MNCs may facilitate upgrading. Third, occasional research collaborations and exchange programs between local and foreign universities as well as foreign firms may establish 'latent' global ties which may become critical resources for developing and linking regional innovation systems to (other) high-tech clusters (see also Carlsson, 2006). However, although such policy efforts to develop 'new Silicon Valleys' seem promising, they are also very ambitious and may be constrained by the increasing commoditization and global distribution of knowledge work. The alternative notion of KSCs as a new distinct and quite sustainable type of cluster may assist regional policy-makers, in particular in developing countries, in framing an alternative, more feasible and shorter-term path to grow skills and diversify from low-cost manufacturing.

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Tables and Figures

Figure 1: Knowledge Services Sourced Globally (Selection) (ORN Survey)

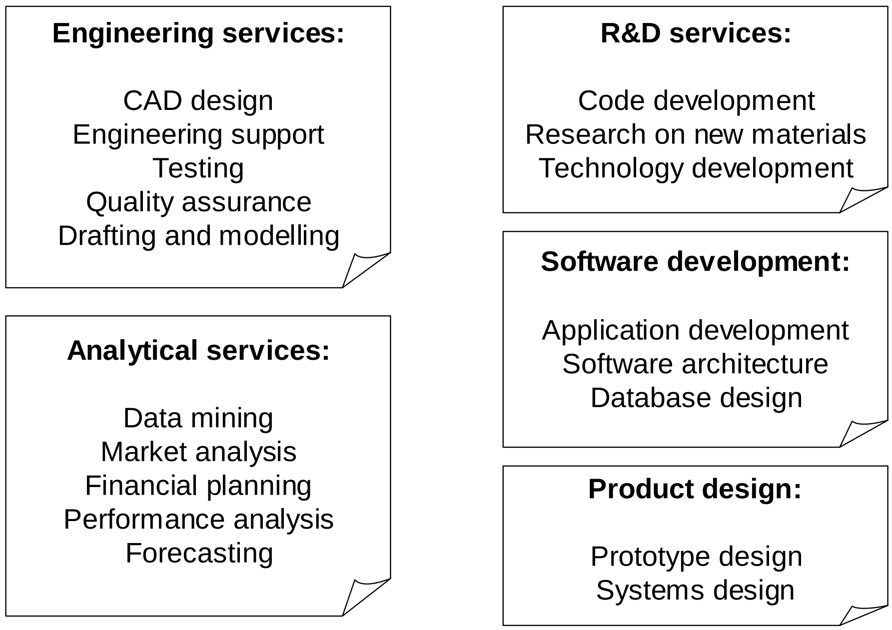

Figure 2: Share of Knowledge Services Projects Offshored to Particular Locations (U.S. client firms)

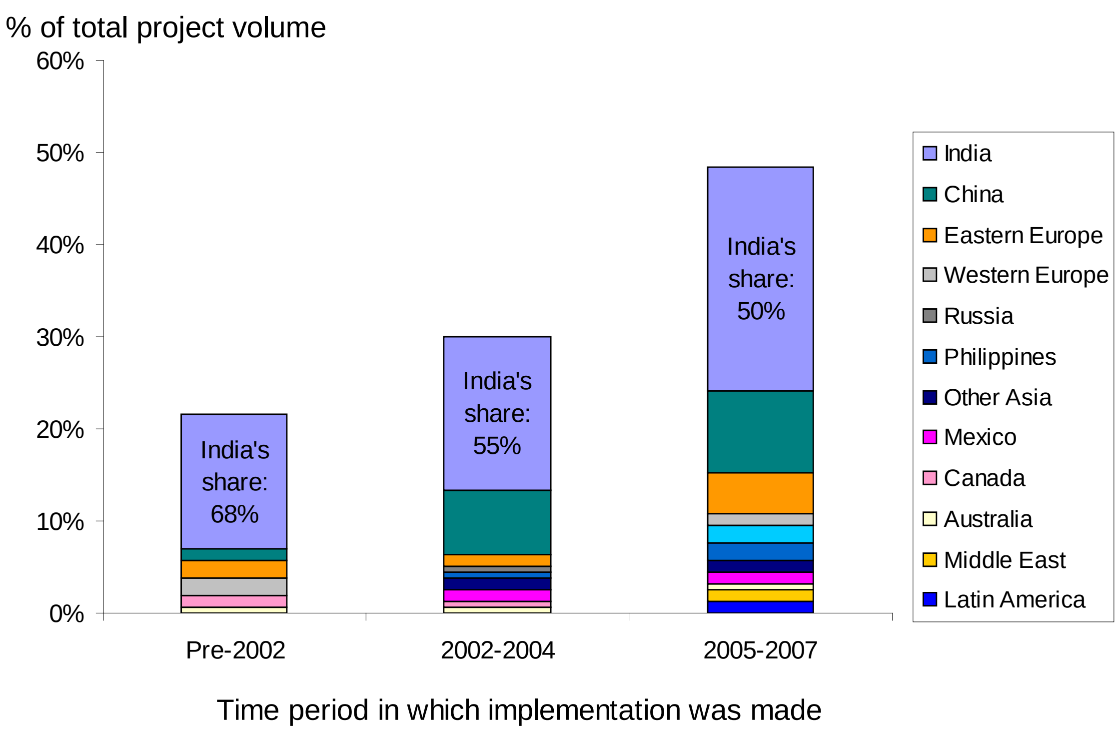

Figure 3: Perceived Commoditization of IT and Knowledge Services (ORN Survey)

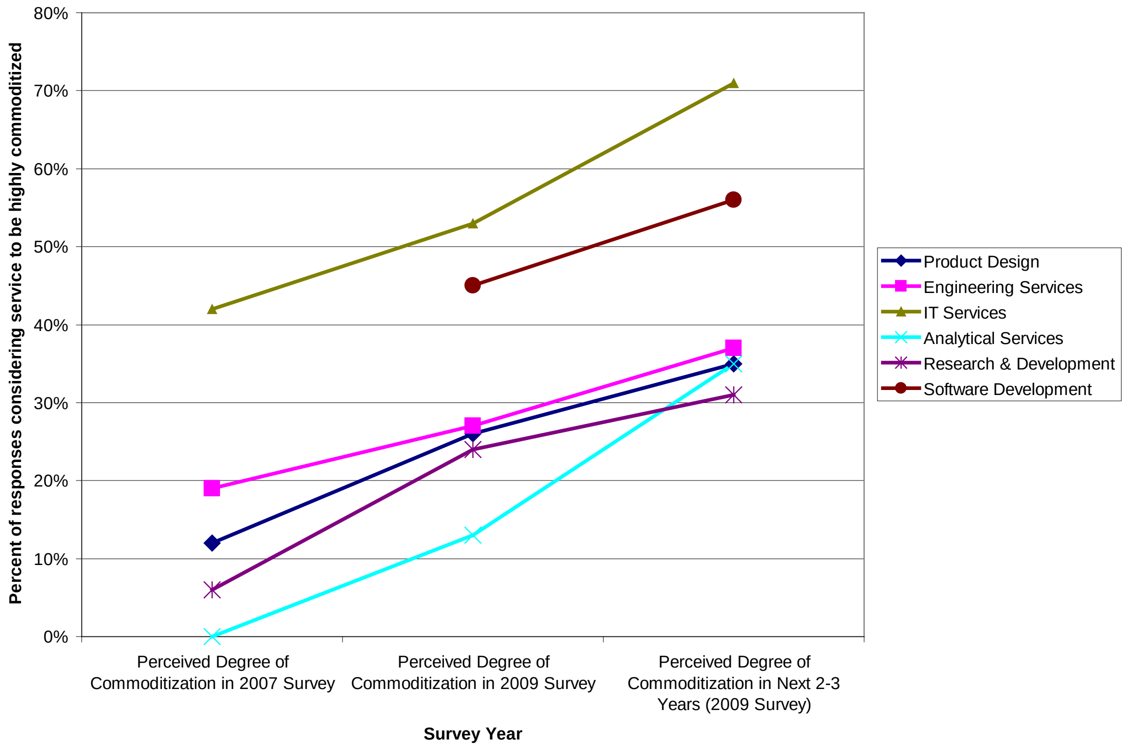

Figure 4: Importance of location factors for sourcing knowledge services (% of responses rating factor as important)

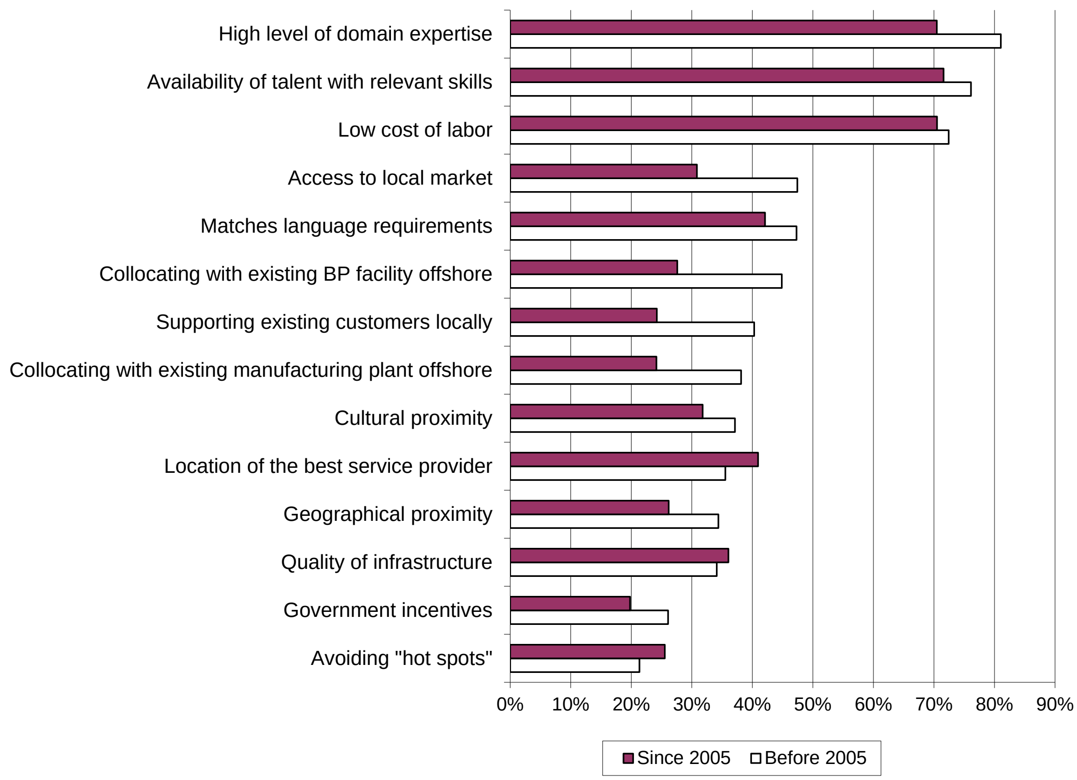

Figure 5: Service commoditization and cluster attractiveness

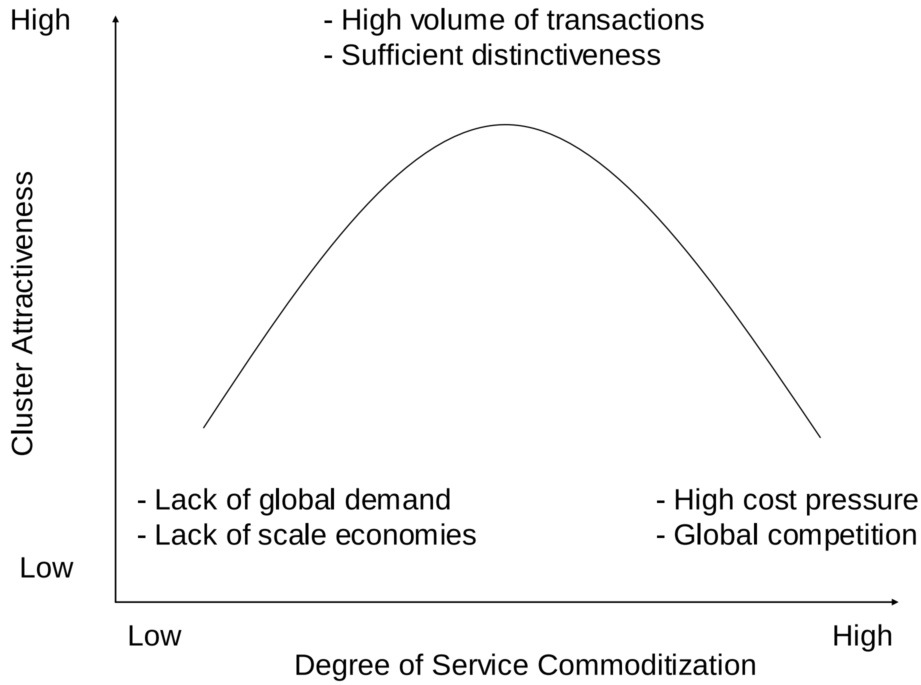

Figure 6: Distribution of sourcing destinations for knowledge services (%): firms with / without cost imperative (= 'Saving labor costs' important driver)

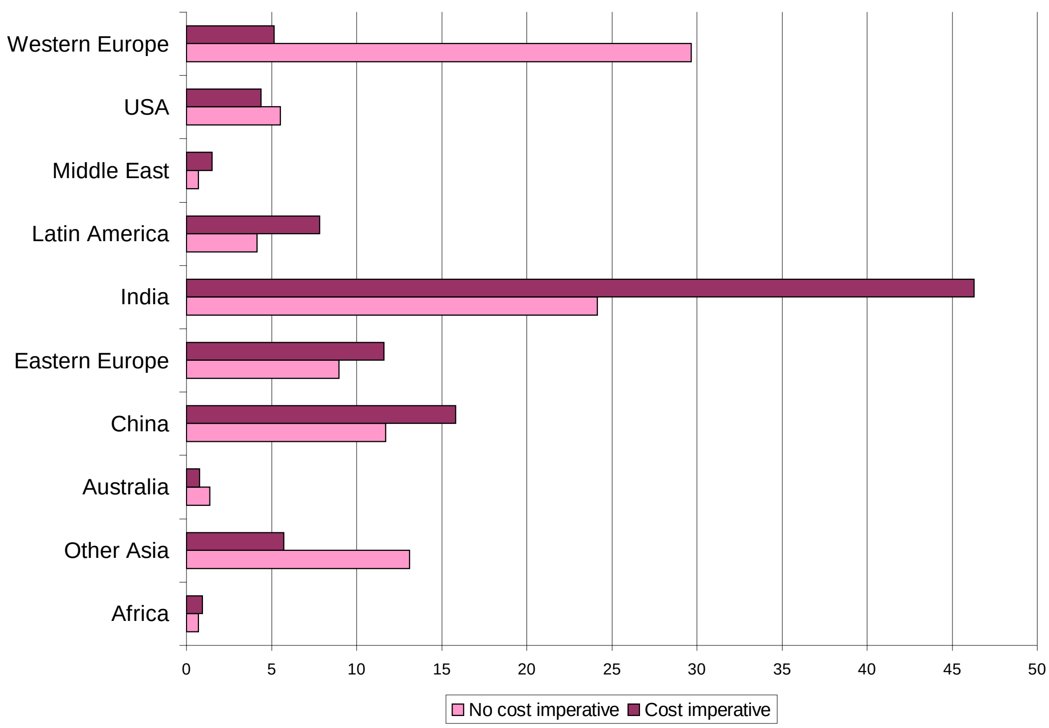

Table 1: Examples of KSCs by type of expertise (adapted from GlobalServices, 2008)

Domain of Expertise	**Established KSCs (by 2008)**	**Emerging KSCs (in 2008)**
Business Analytics	Bangalore, Chennai, Dublin, Hyderabad, Mumbai	Ho Chi Minh City, Pune, Shenzhen
Engineering Services	Bangalore, Chennai, Guangzhou, Pune, St. Petersburg	Coimbatore, Delhi, Moscow, Prague
Product Development Services	Bangalore, Chennai, Ho Chi Minh City, Moscow, Shanghai	Bucharest, Pune, Sao Paulo
Research and Development Services	Bangalore, Dublin, Moscow, Shanghai, St. Petersburg	Beijing, Bucharest, Chennai, Prague
Testing	Bangalore, Chennai, Ho Chi Minh City, Hyderabad, Shanghai	Bucharest, Cairo, Sao Paulo

Table 2: Comparison of different types of clusters

	Low-Cost Manufacturing Clusters	**High-Tech Clusters**	**Knowledge Services Clusters**
Types of products / services delivered	Manufacturing of intermediate components within product value chains (e.g. automobiles)	High-end R&D, product/system development for high-tech industries (e.g. biotech)	Software services, engineering, product design, some R&D, analytics for clients across industries
Location	Mostly developing countries	Mostly developed countries	Mostly developing countries
Need for low-cost vs. skilled labor	Low-cost labor	High-skilled labor	High-skilled, but lower-cost labor
Degree of process commoditization	Medium to High	Low	Medium
Formal Qualification Needed	Typically not (no university degrees)	University degrees	University degrees, but often little experience
Ties between firms and universities	No particular	Training, research collaborations	Mostly training
Client base	Mostly Global: Manufacturing firms (e.g. OEMs) based in developed countries	Regional/Global: High-tech firms based in developed countries	Mostly Global: Client firms and service providers in developed and emerging economies
Basic institutional support structures	Investment promotion	Sophisticated (research-oriented universities, patent and intellectual property regulation)	Educational institutions, investment promotion
Examples	Electronics, garment manufacturing, and automotive production clusters in Asia and Latin America (e.g. Altenburg & Meyer-Stamer, 1999; Humphrey & Schmitz, 2002; Depner & Bathelt, 2005)	IT, biotech, nanotech, photonic clusters in U.S. and Western Europe, e.g. Silicon Valley, Route 128, Research Triangle, OpTec Berlin-Brandenburg (Saxenian, 1994, 2000; Powell et al., 1996; Iammarino & McCann, 2006; Sydow et al., 2010, 2011)	Software services, engineering and R&D support clusters in Asia, Latin America and Eastern Europe (Bresnahan et al., 2001; Zaheer et al., 2009; Kesidou & Romijn, 2008; Manning et al., 2010, 2012; Altenburg et al., 2008)